

DIRECT TESTIMONY OF
CHRISTOPHER VILLARREAL
ON BEHALF OF THE
SOUTH CAROLINA SOLAR BUSINESS ALLIANCE, INC.

BEFORE THE
PUBLIC SERVICE COMMISSION
OF SOUTH CAROLINA

DOCKET NO. 2018-319-E

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I. INTRODUCTION AND PURPOSE OF TESTIMONY

Q. Please state your name and qualifications.

A. My name is Christopher Villarreal. I am President of Plugged In Strategies, a consulting group that provides services and expertise on grid modernization, distribution system planning, and related programs and policies. My business address is 9492 Olympia Drive, Eden Prairie, Minnesota, 55347.

Q. Please provide your educational background.

A. I graduated from Baylor University in 1997 with a Bachelor of Arts in History.

Q. Please describe your work and professional experience.

A. I have 20 years of experience in the electricity policy and regulatory field, with the past 10 years focused on grid modernization and distributed energy resources (DER) at the state level. This includes an understanding of the policy and technical components of the distribution system and technologies. Due to this experience, I have participated in several training sessions in the United States and internationally on grid modernization and distribution system planning and continue to participate in several working groups and workshops at state commissions around the country.

I began my work experience in 1998 as a paralegal working in the Energy Law practice of Verner Liipfert Bernhard McPherson and Hand in Washington, D.C. I worked primarily on cases before the Federal Energy Regulatory Commission (FERC) and the United States Court of Appeals for the District of Columbia Circuit. Through 2006, I worked at several other law firms in Washington, D.C. focused entirely on energy proceedings before FERC and at several state utility Commissions.

In 2006, I started at the California Public Utilities Commission (CPUC) as a Regulatory Analyst. In that capacity, I worked on several leading proceedings including development of policies on Smart Grid, rate design, energy storage, and demand response. In addition, I authored or co-authored several white papers. I was also active in several national

1 activities related to Smart Grid including active participation at the Smart Grid
2 Interoperability Panel, which was managed by the National Institute of Standards and
3 Technology to identify and develop standards to support the Smart Grid, and at the North
4 American Energy Standards Board.

5 In 2015, I began work at the Minnesota Public Utilities Commission as Director of Policy.
6 At the Minnesota PUC, I provided policy analysis to the Commission on topics including
7 rate design, grid modernization, and distribution system planning. At the Minnesota PUC,
8 I was an active participant in the Department of Energy's DSPx initiative, which created a
9 framework for consideration of grid modernization investments by utilities.

10 In 2016, I was named as the Staff Chair of the National Association of Regulatory Utility
11 Commissioners (NARUC) Staff Subcommittee on Rate Design. As Staff Chair, I oversaw
12 the production of the NARUC Distributed Energy Resources Rate Design and
13 Compensation Manual (DER Manual) to assist state utility commissions in becoming more
14 educated on DER, the impacts on historic ratemaking practices, an overview of impacts
15 from DER on rate designs and compensation methodologies, and an outline for information
16 to gather in advance of action on DER.

17 In 2017, I started Plugged In Strategies. In my current role, I provide consulting services
18 related to the following topics:

- 19 • Grid Modernization;
- 20 • Distribution System Planning;
- 21 • Data Access and Data Privacy;
- 22 • Distributed Energy Resources; and,
- 23 • Rate Design.

24 In general, I provide assistance educating on the evolution of the distribution system in
25 response to the growing role of DER. This includes providing educational seminars,
26 participating in workshops, and assisting with planning for the ratemaking, rate design, and
27 business model changes coming to the electricity system. This includes an understanding

1 of a variety of market designs, regulatory and utility models, and how these models will
 2 evolve in response to changing customer expectations and availability of technology. A
 3 copy of my CV is attached as **Exhibit CRV-1**.

4 **Q. Have you previously filed expert testimony in a proceeding before the South Carolina**
 5 **Public Service Commission?**

6 A. No.

8 **Q. Have you previously filed expert testimony in a proceeding before other state utility**
 9 **commissions?**

10 A. Yes. I submitted testimony in the following cases:

12 Before the Michigan Public Service Commission, Case No. U-20134, In the matter of the
 13 application of Consumers Energy Company for authority to increase its rates for the
 14 generation and distribution of electricity and for other relief.

16 Before the Michigan Public Service Commission, Case No. U-20162, In the matter of the
 17 application of DTE Electric Company for authority to increase its rates, amend its rate
 18 schedules and rules governing the distribution and supply of electric energy, and for
 19 miscellaneous accounting authority.

20 **Q. Are you sponsoring any exhibits?**

21 A. Yes, I am sponsoring the following exhibits:

22 CRV-1: CV of Christopher Villarreal

23 CRV-2: "Integrated Distribution Planning," Department of Energy, prepared for the
 24 Minnesota Public Utilities Commission (August 2016)

25 CRV-3: "Integrated Distribution Planning: A Path Forward," GridLab (June 2018)

II. TESTIMONY OVERVIEW

Q. What is the purpose of your testimony today?

A. My testimony addresses Duke Energy Carolinas' (DEC) proposed distribution system investments as outlined in the testimony of Jay Oliver,¹ the development of DEC's Grid Improvement Plan (Plan),² costs associated with the Plan, and the need for better organization and planning at DEC to ensure it builds a modern distribution system that cost-effectively meets customers' needs and is able to integrate increasing amounts of DER.

Q. Please summarize your concerns with DEC's Plan and Witness Oliver's testimony.

A. The Plan submitted by Witness Oliver does not offer or articulate a long-term vision for the distribution system that is more integrated and optimized with the increasing amount of DER, or how it plans to evolve the functions of the distribution system in response to these changing conditions. In addition, the Plan and Witness Oliver's testimony fails to describe in any detail the specifics associated with how DEC's proposed grid modernization projects were identified, how these projects are being organized, whether there is a strategy for implementation, and how these technologies will support the long-term vision of South Carolina to encourage and utilize increasing amounts of DER, including energy efficiency, demand response, and larger, distribution-connected solar.

As such, the Plan itself and the associated cost recovery requested by DEC should be rejected by the Commission, pending more detail on the investments and strategy from DEC consistent with the recommendations described in my testimony. Due to the changing nature of the distribution system and the considerable spending proposed by DEC, it is imperative that the Commission reject this application as premature and in need of additional details, and order DEC to engage with stakeholders to develop a more

¹ *In the Matter of: Application of Duke Energy Carolinas, LLC For Adjustments in Electric Rate Schedules and Tariffs*, Direct Testimony of Jay W. Oliver for Duke Energy Carolinas, LLC, before the Public Service Commission of South Carolina, Docket No. 2018-319-E (November 8, 2018) (Oliver Testimony).

² *In the Matter of: Application of Duke Energy Carolinas, LLC For Adjustments in Electric Rate Schedules and Tariffs*, Direct Testimony of Jay W. Oliver for Duke Energy Carolinas, LLC, "Duke Energy Grid Improvement Plan South Carolina 2018," Oliver Exhibit 9 (November 8, 2018).

1 descriptive and transparent distribution planning process that will serve as the foundation
2 for a long-term vision for the State.

3
4 My testimony addresses concerns with Witness Oliver's testimony and the Plan based on
5 the lack of a detailed and coherent distribution system planning process done in conjunction
6 with stakeholders to ensure that DEC's proposed investments not only ensure reliability
7 but also account for and anticipate the distribution system's new roles and tasks in response
8 to changing technologies and customer preferences. As the distribution utility, DEC will
9 be central to facilitating these changes. For example, DEC will be the primary conduit
10 through which customers engage as they seek to interconnect new solar and ensure their
11 electric vehicles have sufficient charge. DEC also possesses data and usage information
12 critical for customers and the businesses that market to them to identify investments that
13 increase energy efficiency and enable greater customer control of energy usage. Finally,
14 DEC possesses information vital to locating DER in locations that maximize transmission
15 and distribution infrastructure while serving customer load. Technology improvements
16 and cost declines in DERs such as wind, solar, and energy storage and energy efficiency
17 and demand response options, such as smart thermostats will continue to drive increased
18 adoption, making DEC's role even more vital.

19
20 Despite this changing customer profile, DEC's proposed grid modernization investments
21 does not successfully lay the foundation for greater utilization of DER. In other words,
22 DEC's Plan may increase costs to South Carolina customers without putting into place the
23 necessary investments into the distribution and transmission system to support the
24 increasing adoption rate for DER or identifying the potential role of DER in meeting future
25 grid needs. Pre-approval and cost recovery of these investments inappropriately puts the
26 risk upon ratepayers that these are the right investments at this time. A more thorough and
27 transparent distribution system planning process should be developed, with more input
28 from customers and stakeholders, to ensure DEC's investments are what is needed to
29 support customers, and are not investments in capital intensive projects that will primarily
30 benefit DEC's shareholders.

Q Please define DER.

A. I use the definition of DER provided by the NARUC DER Manual:

“A DER is a resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load. Examples of different types of DER include solar photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE).”³

This definition notes that DER is not limited to rooftop solar, but includes a wide variety of technologies and resources, including community solar, energy efficiency, demand response, microgrids, and electric vehicles. The key component is that these are connected to the distribution system, whether they are in front of or behind the meter.

Q. Why is it important to define DER?

A. It is important because discussions about DER tend to be limited only to rooftop solar. However, DER encompass multiple resources that, either individually or collectively, can provide services to the distribution or transmission system, assuming the systems are constructed to effectively use, integrate, and optimize them.

Q. Are there other NARUC activities that may be of use for this proceeding?

A. Yes. NARUC recently created a new initiative in conjunction with the National Association of State Energy Officials called the Task Force on Comprehensive Electricity

³ *Distributed Energy Resources Rate Design and Compensation: A Manual Prepared by the NARUC Staff Subcommittee on Rate Design*, National Association of Regulatory Utility Commissioners at 45 (November 2016) (DER Manual). Available at: <https://pubs.naruc.org/pub/19FDF48B-AA57-5160-DBA1-BE2E9C2F7EA0>.

1 Planning (Task Force).⁴ The purpose of this Task Force is to “develop new approaches to
 2 better align distribution system planning and resource planning processes.”⁵ According to
 3 NARUC, there are five benefits of comprehensive electricity planning:

- 4
- 5 • Improve grid reliability and resilience;
- 6 • Optimize use of distributed and existing energy resources;
- 7 • Avoid unnecessary costs to ratepayers;
- 8 • Support state policy priorities; and,
- 9 • Increase the transparency of grid-related investment decisions.⁶

10

11 Lastly, NARUC notes that “ensuring distribution system investments are right-sized and
 12 consider approaches such as non-wires alternatives can lower costs and offset supply-side
 13 needs.”⁷

⁴ “NARUC and NASEO Establish New Joint Task Force on Comprehensive Electricity Planning,” NARUC (November 13, 2018). Available at: <https://www.naruc.org/about-naruc/press-releases/naruc-and-naseo-establish-new-joint-task-force-on-comprehensive-electricity-planning/>.

⁵ *Id.*

⁶ “Task Force on Comprehensive Electricity Planning,” NARUC (2018). Available at: <https://pubs.naruc.org/pub/83CECF9B-91AB-2791-CD6D-FFBD459AFCC9>.

⁷ *Id.*

III. OVERVIEW OF DEC'S PLAN

Q. Please summarize Witness Oliver's explanation of how DEC created its Plan.

A. Witness Oliver describes that DEC identified seven "megatrends" that are impacting distribution utilities and states across the region and in Duke territories in other states. The megatrends are:

1. Population and business growth continues in South Carolina and is heavily concentrated in urban and suburban areas;
2. Technology is advancing at a rapid rate in the areas of renewables and distributed energy resources (DERs), which means there are new types of load and resources impacting the grid;
3. Technology is also advancing rapidly within the devices and systems that operate and manage the T&D grids, offering new capabilities and requiring new functionalities;
4. Customer expectations and use of the grid are very different from generations past;
5. There has been an increase in environmental commitments from the international to local level in DE Carolinas' service territory;
6. The number, severity and impact of weather events on DE Carolinas' customers has been increasing significantly; and
7. The threat of physical and cyber attacks on grid infrastructure is more sophisticated and is on the rise.⁸

Witness Oliver continues by describing several additional South Carolina-specific factors, including increasing demand, declining reliability factors, and increasing climate and weather impacts on operations.⁹ Witness Oliver then includes additional factors that guide specific investments in order to respond to cybersecurity risks, system protection requirements, and programs to assist the customer experience.

⁸ Oliver Testimony at 27-28.

⁹ Oliver Testimony at 7-8.

1 **Q. Do you agree with DEC's characterizations and identification of the megatrends?**

2 A. Yes. I would tend to agree that those encompass many of the challenges and opportunities
3 facing distribution utilities across the country today.
4

5 **Q. Do you have any comments on DEC's process of reviewing the megatrends?**

6 A. Yes. I believe that DEC undertook a serious examination of their system and how to
7 respond to these megatrends, including the convening of two invitation-only stakeholder
8 workshops. These would appear to be reasonable steps for a distribution utility to take to
9 better plan their operations in advance of significant changes expected to occur soon across
10 the country with the growth of DER. However, DEC does not appear to have held
11 extensive meetings with customers in advance of this filing.
12

13 **Q. Does the Plan propose a clear path forward for DEC to respond to these megatrends?**

14 A. No. The Plan is a jumble of utility investments in the distribution system that DEC claims
15 are in response to the megatrends and DEC goals, but DEC fails to put these investments
16 into any context or in relation to each other. Additionally, it is unclear how some of the
17 megatrends are addressed by the Plan.
18

19 **Q. Please explain the lack of clarity in how some megatrends are addressed by the Plan.**

20 A. For example, DEC identifies that customer preferences are changing. Witness Oliver notes
21 a few customer-focused initiatives, including brief mentions of providing customers
22 greater access to their usage information.¹⁰ However, neither Witness Oliver's testimony
23 nor the Plan provide any detail or description of how those identified investments will
24 benefit customers.
25

26 Oliver Exhibit 11, which was used during the stakeholder meetings, includes a description
27 of how each investment benefits customers, which is in contrast to the filed Plan. However,
28 even in that document, the "Value to Our Customers" is explained in utility terms and what

¹⁰ Oliver Testimony at 10.

1 the utility provides to customers as opposed to how customers themselves can realize
2 benefits from these investments.¹¹

3
4 **Q. Are there other examples you can discuss of how megatrends do not clearly translate**
5 **into the Plan?**

6 A. Yes.

7 For the Power Electronics for Volt/VAR program, which assists integrating solar into the
8 distribution system by addressing potential voltage and VAR variations, Exhibit 11 notes
9 several grid enabled capabilities from this investment, including better monitoring and
10 visibility, increasing hosting capacity analysis, and facilitating two way power flow. In
11 terms of customer value, however, DEC fails to mention that this program could enable
12 greater customer adoption of solar, facilitate the integration of solar, or reduce
13 interconnection times. In the actual Plan, DEC fails to describe how customers will benefit
14 from this, or any other program. Lastly, DEC also fails to describe how this program could
15 be integrated with advanced inverters which are capable of providing similar volt/VAR
16 support before electricity is even delivered onto the distribution system.

17
18 A second example relates to customer data access. Witness Oliver notes that amongst the
19 types of investments necessary to modernize the grid include “Smart meters to provide
20 improved customer usage data, enhanced outage detection to improve customer service,
21 and access to increased customer options to manage energy use and save money.”¹²
22 However, the Plan does not include any investments to enable this specific item, nor, as
23 described elsewhere in my testimony, does Witness Schneider or Witness Hunsicker
24 discuss this either. This is a significant lost opportunity for DEC. The Plan is devoid of
25 any details relating to actually implementing Green Button Connect, other than in Exhibit
26 11, which is not carried over into the actual Plan. This is the opportunity for DEC to lay
27 the foundation for customer access to their own information and enable the sharing of their

¹¹ See, e.g., Oliver Exhibit 11 at 74 which describes Green Button and the customers benefits of “Maintain Reasonable Rates,” “Improve Reliability, Safety, and Resiliency,” and “Meet or Exceed Customer Expectations.” None of these “benefits” include enablement or empowerment of customers to better manage usage, or facilitate growth of DER.

¹² Oliver Testimony at 10.

1 information with authorized third parties via an open standard like Green Button Connect.
 2 Without the implementation details, there is no way to determine the pace of
 3 implementation, the expectations for utilization of solutions built on open standards, as
 4 opposed to proprietary solutions, or the means and process for enabling the customer to
 5 obtain and share their information.
 6

7 **Q. How much does DEC believe these investments will cost DEC customers?**

8 A. Witness Oliver states that the investments proposed in the Plan will cost \$336 million in
 9 2019 and \$534 million in 2020, with South Carolina customers responsible for \$68 million
 10 in 2019 and \$111 million in 2020.¹³ Overall, for the entirety of the three year plan, Duke
 11 will spend \$454.6 million throughout South Carolina, and that only covers capital
 12 investments identified in the plan, with DEC responsible for \$311 million of that total.¹⁴
 13 This is in addition to the \$3.5 billion DEC has invested in transmission and distribution
 14 infrastructure over the past 5 years, with \$1 billion of that invested in transmission, and the
 15 rest, \$2.5 billion, in distribution.¹⁵ It is important to note that these investments are part of
 16 a larger 10 year, \$13 billion grid modernization effort by Duke across North and South
 17 Carolina.¹⁶
 18

19 **Q. Where are the details of these expenditures described?**

20 A. They are described in DEC's Grid Improvement Plan, filed as a part of Witness Oliver's
 21 testimony.¹⁷ The Grid Improvement Plan document consists of a one-page overview that
 22 summarizes the programs and associated capital expenditure amounts for which DEC is
 23 requesting approval, followed by 63 pages of individual program descriptions and more
 24 detailed cost breakdowns. Witness Oliver's testimony provides additional information on
 25 how the programs within the Grid Improvement Plan fall into one of several categories of
 26 investment.

¹³ Oliver Testimony at 12-13, citing DEC Witness Smith Testimony, Exhibit 3, page 6.

¹⁴ Oliver Exhibit 9 at 1.

¹⁵ Oliver Testimony at 15.

¹⁶ <https://www.utilitydive.com/news/duke-energy-to-harden-north-carolinas-power-system-with-13b-initiative/440524/>

¹⁷ Oliver Exhibit 9.

1 First, Witness Oliver outlines DEC's grid investment strategy focused on necessary
 2 investments for compliance-driven requirements, including protecting transmission and
 3 distribution assets from cyber and physical security events, or those under mandates.¹⁸
 4

5 Second, Witness Oliver discusses those investments necessary to meet the rapid changes
 6 occurring across the electricity system. As noted by Witness Oliver, "Work in this category
 7 is usually related to system communication, automation, and intelligence and must be
 8 executed at a deliberate pace while ensuring not to deploy new technology before it has
 9 reached maturity."¹⁹ Additionally, Witness Oliver describes investments in this section as
 10 those that support system optimization, interoperability, and support enterprise-wide
 11 solutions.²⁰
 12

13 Lastly, Witness Oliver discusses those investments that support a customer experience.
 14 Included in this consideration is a recognition that benefits from these investments must
 15 flow to all of DEC's customers, not just few or those who can best realize the savings from
 16 DEC's investments.²¹
 17

18 **Q. Please discuss your concerns with the way the Plan is described.**

19 A. In and of itself, the steps described by Witness Oliver are adequate to identify certain
 20 investments across the distribution system. However, in order to meet DEC's goal for the
 21 Plan to have a distribution system prepared for the future, or, as stated in the South Carolina
 22 State Energy Plan, "an advanced, integrated grid to manage and optimize the increasingly
 23 dynamic flow of electricity," then this plan simply does not meet these goals.²²
 24

25 **Q. Please explain why.**

26 A. The Plan is simply a listing of 19 individual programs without any clear linkage to an
 27 overarching strategy, or alignment with each other, or a description of how one investment

¹⁸ Oliver Testimony at 33-34.

¹⁹ *Id.* at 35.

²⁰ *Id.* at 36-38.

²¹ *Id.* at 38-39.

²² *Id.* at 29-30.

1 relates to another. More problematically, these investments lack any detail that explains
2 how the distribution system itself will be better optimized and integrated, and how these
3 investments, when used together, will result in an optimal and integrated operation of the
4 distribution system.

5
6 Specifically, the Plan provides no description of how the programs were identified, whether
7 there were other items under consideration, how the programs will help meet specific goals,
8 or how they are tied to specific objectives as identified by Witness Oliver. Most
9 troublingly, the Plan makes no mention of what happens at the end of the three-year
10 investment cycle. DEC fails to describe a planning process for the next iteration, or how
11 these investments lead to some logical next round of investments, or whether there is any
12 longer-term planning process at all. There is simply not enough detail as presented in
13 DEC's testimony and Plan to support the approval of this application.

14
15 **Q. Does DEC provide any cost and benefit analyses for these investments?**

16 A. Exhibits 7 and 8 provide examples of DEC's cost-effectiveness studies for two programs,
17 but does not provide detailed cost and benefit analyses for each program, or show any
18 details as to why these projects at the specific identified locations are the most cost-
19 effective solutions. DEC also fails to explain in detail how these investments will enable
20 a future distribution system in line with the state's energy plan, or make more effective use
21 of DER, or enable customers to achieve their own goals. The lack of detailed analyses for
22 the programs proposed in the Plan does not provide the Commission with a sufficient
23 record on which it can act. Furthermore, there is no record evidence to show that DEC
24 considered how these programs are in alignment with each other, whether there are specific
25 areas across DEC's system that is in more need than others, or whether these are in fact the
26 most cost-effective solutions for each location.

27
28 **Q. Is there an example that reflects your concern about alignment of projects?**

29 A. Yes. DEC's Plan has a section on Energy Storage. In that section, DEC identifies three
30 potential capacity projects at Fants Grove 12 kv circuits 1205 and 1206, Campton Retail

Bank 1 circuits 1201, 1202, and 1203, and New Prospect Retail circuits 1201 and 1203.²³ A search of the Plan finds that Fants Grove and Campton are mentioned a couple of times. Fants Grove circuit 1205 is also identified as a location for an automated switch to support a self-optimizing system,²⁴ as well as a location for a new single phase tie between circuits 1205 and 1206.²⁵ DEC does not describe how these locations were identified, what DEC's "case-by-case assessments" for storage locations includes, or whether either of those investments are being planned in conjunction with a potential storage investment, or with each other. Can the storage investment defer either of these investments? Is the self-optimization investment going to be aligned with the storage resource? How is DEC planning to have these investments work together?

IV. NEED FOR BETTER DISTRIBUTION SYSTEM PLANNING AND ALIGNMENT

Q. Taken together, why are all of these issues problematic?

A. They are problematic because DEC's Plan is missing important information related to the organization, alignment, and prioritization of the investments and planning processes, and does not justify the significant proposed investments in the distribution system. In essence, DEC's Plan asks the Commission to accept this list of new projects as sufficient evidence of a comprehensive distribution planning effort. The investments in the Plan cover three years' worth of distribution system spending but the Plan fails to provide support for that spending. Moreover, the Plan fails to fully describe a distribution system planning process that would provide necessary detail into how these investments will support a future utility distribution system that is fully integrated with DER as expected under the State Energy Plan. The Plan also fails to provide a clear path as to how those investments will enable a more modernized grid as envisioned by the state, and there is no clear explanation of a framework for how DEC is considering distribution system planning for the future. As such, it would not be reasonable to rely on the Plan to authorize DEC to recover from customers the requested costs for distribution system spending through 2021.

²³ Witness Oliver Exhibit 9 at 23.

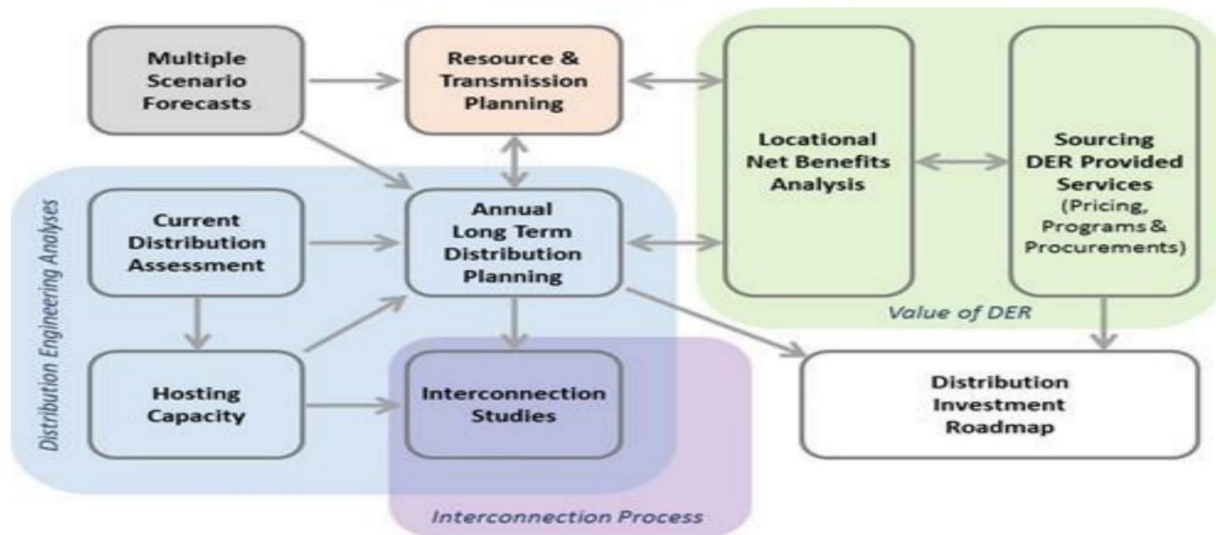
²⁴ *Id.* at 5.

²⁵ *Id.* at 24.

1 **Q. Please explain what you mean by a framework.**

2 A. In a document developed for the Minnesota Public Utilities Commission, the Department
3 of Energy (DOE) developed an image that provides a concise perspective of how traditional
4 distribution system planning is generally done and how it needs to become more integrated
5 with other pieces of the utility organization.²⁶

Figure 1: Integrated Distribution Planning

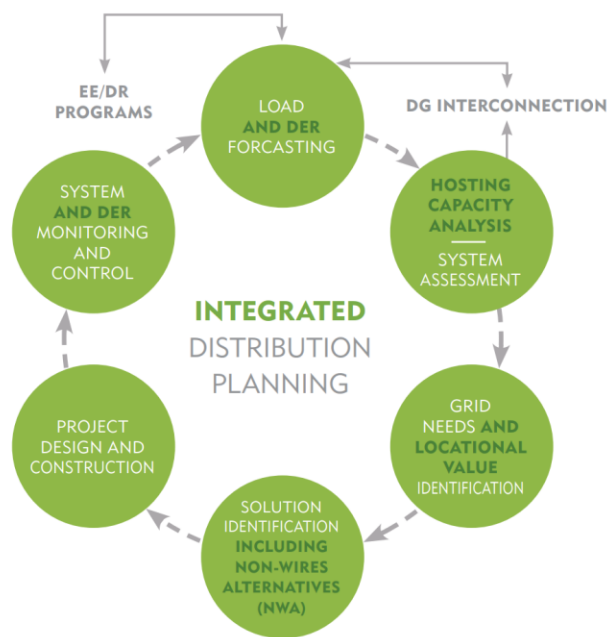


6
7 As described in this figure, the lower left-hand section in blue includes typical utility
8 engineering grid planning processes, which, going forward, need to be integrated with
9 hosting capacity analyses and information the utility can gather from the interconnection
10 process. By integrating the four engineering components shown in the figure, the
11 traditional distribution planning process can be better informed about what is going on
12 across the system. The next component is then engaging the Distribution Engineering
13 Analysis process with the utility's scenario forecasts and its resource and transmission
14 planning process. This ensures that the distribution system is not only being planned with
15 information about its own system, but that it can inform and be informed by the load and
16 resource forecasts. This results in a more integrated distribution planning process and
17 identification of necessary distribution investments to support the changing nature of the
18 distribution system.

²⁶ "Integrated Distribution Planning," ICF International (August 2016). Exhibit CRV-2.

1 **Q. Are there other examples of what an integrated distribution plan looks like?**

2 A. Yes. In 2018, GridLab released a paper describing the need for integrated distribution
 3 planning.²⁷ As detailed in the report, integrated distribution planning requires alignment
 4 and organizing across the utility. Consistent with the DOE Integrated Distribution
 5 Planning report, the GridLab paper notes that functions such as forecasting, hosting
 6 capacity, enhanced interconnection processes, greater availability of data, more informed
 7 stakeholder engagement, and visibility into the distribution system are necessary to ensure
 8 that the grid is being planned and operated more efficiently.²⁸ This includes utilization of
 9 DER and an understanding of customer behavior with infrastructure investments so that
 10 the utility is not just investing in the next iteration of a product but is more proactively
 11 planning for the changes to the system.



12 This image represents the process for an integrated distribution planning effort, and notes
 13 that previously disparate planning processes must become integrated with the distribution

²⁷ “Integrated Grid Planning: A Path Forward,” GridLab. Exhibit CRV-3.

²⁸ *Id.* at 8.

1 planning process.²⁹ Notably, this identifies the need for energy efficiency and demand
2 response to be, first, better included with load and DER forecasting, and then, second, the
3 forecasting process include information from the interconnection process. From there, the
4 process continues to ensure that the distribution planning effort makes use of all available
5 data across the utility so that utility investments in the distribution system are meeting
6 actual needs, based on actual data, and is not, instead, just investing in capital without
7 regard to what is truly happening across the system.

8
9 **Q. Do you agree with DEC separating transmission and distribution investments**
10 **between maintaining base infrastructure and grid improvements?**

11 A. No. As shown by both DOE and the GridLab reports, the distribution system is no longer
12 just about maintaining the system, but instead the entirety of the distribution system must
13 be planned in line with forecasts and assumptions about DER, customer behavior, and
14 changing usage profiles. It does little good for customers and their bills if a utility invests
15 in a technology to better integrate DER but keeps up business as usual in the operation and
16 planning of the traditional distribution and transmission system. As the DOE image
17 illustrates, distribution planning must start including data from a variety of places it
18 typically does not include, and it must start working together with resource and
19 transmission planning. Without those linkages, the distribution engineer will plan
20 according to their historic processes, same as the resource planner and transmission
21 planner.

22
23 Furthermore, by not considering the distribution system as a whole, DEC risks losing
24 benefits from DER to the distribution system. For example, rather than investing in new
25 volt/VAR optimization at locations with higher amounts of solar, it may be more efficient
26 to develop programs and communications capabilities to make use of the smart inverters
27 located at solar installations. This type of information would be known by the utility
28 through an update to the interconnection process which makes use of the updated IEEE
29 1547 and UL 1741 standards which enable advanced inverter functionality. Again, the
30 customer (and the market) has made these investments on their own, and if they can provide

²⁹ *Id.*

1 these services to the system, that is a benefit to the ratebase as DEC does not have to use
2 ratepayer funds for the same result.

3 **Q. Does DEC provide any description of its distribution system planning process or**
4 **whether it follows these examples of integrated distribution planning efforts?**

5 A. No. For the immediate purpose of an integrated distribution plan, DEC does not describe
6 how it is using information from its interconnection process, whether it conducts hosting
7 capacity analyses, or how its forecasting is evolving in anticipation of greater amounts of
8 DER. DEC also does not describe how these investments will function as building blocks
9 for future customer needs. Since the Plan fails to provide any discussion on long-term
10 expectations, goals, or a vision, it is unclear to what extent these programs can be leveraged
11 for future roles or uses of the distribution system. In essence, DEC does not explain its
12 existing distribution planning process, does not explain how these 19 programs support its
13 distribution planning process, does not explain how these investments will be used to
14 support the next three-year distribution planning process, and does not identify any
15 particular or specific methodology by which it picked any of the investments or locations
16 of those investments. Lastly, DEC does not explain whether or how it developed this plan
17 in conjunction with the demand forecast group, the demand response and energy efficiency
18 group, the resource planning group, or the transmission planning group.

19 **Q. Does DEC's Plan include any discussion of an integrated distribution planning**
20 **program in the Plan?**

21 A. Yes, albeit with scant information about it. In the Plan, DEC spends one page describing
22 an Integrated Systems Operations Planning investment.³⁰ This page provides very little
23 detail on how this changes existing distribution system planning, it does not explain how
24 or whether it will integrate planning across the distribution system, nor does it describe the
25 types of data that will be collected to enable this investment. The descriptive text in this
26 section does describe the potential role and purpose of integrated system operations
27 planning but provides no other details about it.
28

³⁰ Witness Oliver Exhibit 9 at 39.

1 Included in this description is an Advanced Distribution Planning tool. The Plan fails to
2 describe any further detail about the role, purpose, or intent of this tool. However, DEC
3 does identify the cost. Over three years, this program will cost DEC customers about \$4.8
4 million, with the majority of those costs going to “program management.” It is impossible
5 to tell what program management entails, or just what DEC hopes to achieve with this
6 program. In essence, this planning investment appears woefully inadequate for the
7 purposes of customers and the state, as it fails to adequately plan for the future.

8 **Q. How important is planning for the future?**

9 A. Planning for the future is vital to ensure that investments in the distribution system are
10 identified and organized with other utility functions and follow a transparent process. Both
11 the DOE and GridLab reports are examples of considerations for integrated distribution
12 planning to ensure that investments in the distribution system are done with an eye towards
13 building the grid of the future, in conjunction with other existing utility processes. On the
14 other hand, DEC’s Plan and testimony do not follow those guidelines for future planning.

15
16 **Q. Can you provide an example?**

17 A. Yes. DEC has invested in advanced metering infrastructure (AMI).³¹ Nowhere in Witness
18 Oliver’s testimony, Witness Schneider’s Testimony, Witness Hunsicker’s Testimony, nor
19 in its Plan does DEC describe how data from AMI will be used to inform any of the
20 investments in the distribution system. Without a clear explanation of how or whether that
21 data is being used, customers are not realizing real use and savings from that investment,
22 the utility is not using this valuable information to plan for its system, and it is unclear to
23 what extent Witness Oliver is coordinating with Witness Schneider or Witness Hunsicker.
24 The Plan is completely lacking any reference to the underlying source of data to support
25 the locations of investments in infrastructure, such as AMI. For example, Witness
26 Hunsicker describes updates to DEC’s Customer Information System. This type of
27 investment and source of information is increasingly important and useful to distribution
28 planning efforts as this details the actions of individual customers and can inform planners
29 of changes to demand, where these changes are occurring, and the pace of these changes.

³¹ Oliver Testimony at 17-18; Witness Schneider Testimony at 6.

1 As described below in the discussion on architecture, customer data is a foundational
2 investment that should be available to various groups inside the distribution utility, and not
3 limited to only one or two groups. Yet, nowhere in the Plan is the Customer Information
4 System investment referenced.

5
6 Furthermore, the Plan fails to describe how they are planning for other important sources
7 of information about its system, such as hosting capacity. AMI and hosting capacity are
8 vital to providing sufficient visibility into the distribution system. Visibility is important
9 to gauge the health of a distribution system, including identifying its weaknesses, strengths,
10 areas of potential concern, and areas for utilization of DER as a non-wires alternative
11 (NWA).

12
13 **Q. Can you describe how this compares to the DOE or GridLab models?**

14 A. In both the DOE and GridLab models for integrated distribution planning, there are clear
15 linkages and alignment between various parts of the distribution utility's operations. Both
16 models identify the importance and need for a more organized distribution planning that
17 makes use of information collected across the utility's operations, and that begins to break
18 down the siloes inside the utility. It is not necessary to jump directly into this integrated
19 approach, but, rather, utilities must recognize the need for more and better integration in
20 order to ensure that all investments realize benefits across utility operations to the benefit
21 of the customers. In other words, by breaking down siloes and developing pathways
22 between operations, demand forecasting, DER adoption forecasts, resource planning,
23 distribution planning, and others, the utility can begin to coordinate so that it can more
24 efficiently plan, operate, and manage the distribution system. This type of planning,
25 strategy, and organization is absent from DEC's Plan.

26
27 **Q. Why is data important for planning?**

28 A: Planning for the future also relies on forecasts of demand, DER adoption rates, and
29 locations across the infrastructure that will be impacted by those forecasts. DEC fails to
30 describe how or whether data from their AMI installations is being used in its planning
31 process. DEC does not state whether AMI data is used to develop class load curves, or its

load forecasting model. Failure to better utilize data from advanced meters results in customers not realizing the full value of the AMI investments that have been made, and costs them even more going forward on potentially avoidable distribution system investments. Utilization of all data sources, including AMI and hosting capacity processes are extremely important to ensuring that the distribution planners know what is going on across its system, and how it can better identify locations for upgrades or utilize non-wires alternatives.

Q. What is hosting capacity and why is it important?

A. Hosting capacity, as defined by the Electric Power Research Institute is “the amount of PV that can be accommodated without impacting power quality or reliability under existing control and infrastructure configurations.”³² In essence, hosting capacity is an important source of information to determine where new solar can be accommodated without needing to invest in more infrastructure to integrate that solar. The ability of a utility to run a hosting capacity analysis is indicative of how much visibility a distribution utility has into its own system. Furthermore, hosting capacity can assist developers and the market with identifying areas of potential solar growth without needing to go through an interconnection process and waiting for the answer. This promotes efficiency for developers, customers, and the utility. Hosting capacity can also be used by the utility to proactively determine areas of its distribution system seeing increases in solar adoption, or areas that may soon be in need of investment. This is an example of using data from one location – the hosting capacity analysis – to support a more integrated distribution system planning process.

Q. You also mentioned non-wires alternatives. Can you please describe what you mean?

A. Non-wires alternatives (NWA) are where a single or portfolio of DER can be used to defer or avoid a capital investment in the system and make use of technologies invested in by the customer. An example of a NWA program is the Brooklyn-Queens Demand Management program where a conglomeration of DER, including energy efficiency, energy storage,

³² EPRI, Distribution Feeder Hosting Capacity: What Matters When Planning for DER?, April 2015. Available at: <https://www.epri.com/#/pages/product/000000003002004777/?lang=en-US>.

demand response, solar, and distributed generation are used by ConEd to defer a \$1 billion investment in a new substation.³³ A key component of that initiative was the identification of needs, which can only be accomplished via a more integrated and overarching distribution planning process that encompasses all corners of the utility.

Q. Are there other states that are looking at distribution system planning processes that are similar to what you have described above?

A. Yes. Several states across the country are investigating integrated distribution system planning activities. Examples include:

- Hawaii
- California
- New York
- Minnesota
- Ohio

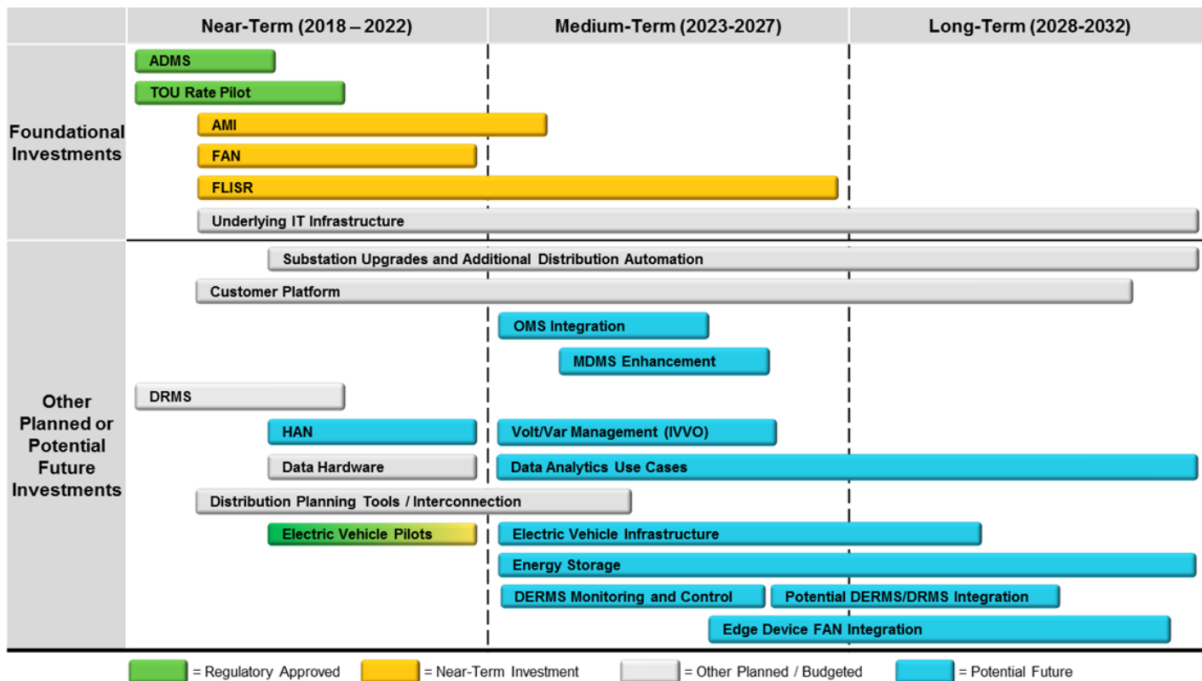
Q. Can you provide any specific examples of a utility distribution plan?

A. Yes. In November 2018, Xcel Energy in Minnesota submitted its integrated distribution plan. This filing was done at the direction of the Minnesota Public Utilities Commission, which is interested in better understanding the details of utility investment strategies for the distribution system as its utilities' distribution system is aging and in need of replacement. As noted by the image below, Xcel's distribution plan looks out over 15 years and plots out the necessary investments over three time increments, plus an identification of what investments are considered necessary or foundational for the evolution of the distribution utility.³⁴

³³ *Brooklyn/Queens Demand Management Program*, Order Implementing Brooklyn/Queens Demand Management Program, New York Public Service Commission, Case 14-E-0302 (December 12, 2014); *Petition for Extension of Time to Implement Brooklyn/Queens Demand Management Program*, Order Extending Brooklyn/Queens Demand Management Program, New York Public Service Commission, Case 14-E-0302 (July 13, 2017).

³⁴ "Integrated Distribution Planning," Xcel Energy, Minnesota Public Utilities Commission, Docket No. E002/CI-18-251 (November 1, 2018). Available at: <https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E098D466-0000-C319-8EF6-08D47888D999}&documentTitle=201811-147534-01>.

Figure 7: Advanced Grid Initiatives 15-Year View



Looking at the distribution system with an eye towards the future and how to get from point A to point B is also consistent with other work done by the DOE to support grid modernization activities by state commissions.

Q. Please explain.

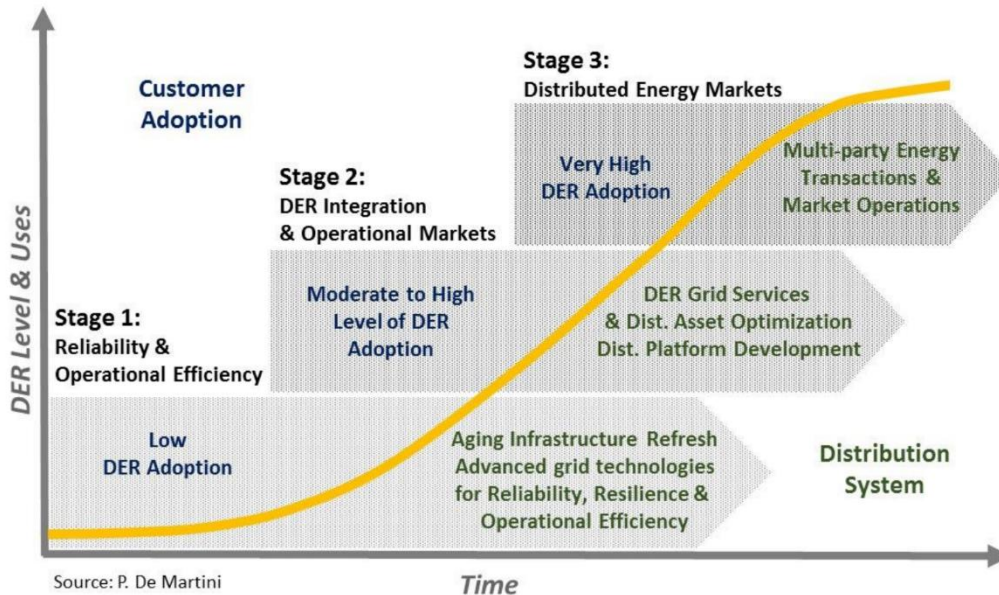
A. In 2015, the DOE initiated a project called the DSPx.³⁵ This project was done with commissions from Hawaii, California, New York, Minnesota, and the District of Columbia. Volume 3 of the DSPx is designed to assist state regulators who are reviewing grid modernization investments or are interested in formulating requirements for a utility distribution system.³⁶ In part, this volume is also intended to help identify necessary grid investments that can accomplish certain goals, but with a realization that technology adoption will likely outpace regulation, which makes planning all the more important. To

³⁵ <https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx>.

³⁶ "Modern Distribution Grid: Decision Guide," DOE, Volume III (June 28, 2017). Available at: <https://gridarchitecture.pnnl.gov/media/Modern-Distribution-Grid-Volume-III.pdf>.

assist states, DOE aligns its recommendations with an initial step: the identification of where a given state or utility is along a technology adoption curve.

Figure 4. Distribution System Evolution



What this image shows is that distribution system investments should be aligned with and slightly ahead of customer adoption of DER.³⁷ At stage 1, there is low DER adoption and the distribution utility is looking at replacing aging infrastructure. The key part of this image is that investments in the distribution system cannot be solely looked at as replacing aging infrastructure, but that these investments are part of a larger and longer-term strategy to support customer adoption of DER and to then integrate those resources into the distribution system. Utility investments that are only looking at the short-term may miss opportunities to lay the foundation for stage 2, or may invest in the wrong solutions that not only do not provide benefits to customers but may increase costs as the utility has to replace those investments prematurely with new technologies.

³⁷ *Id.* at 15.

1 **Q. Are there other important components missing from DEC's Plan or otherwise should**
 2 **be considered?**

3 A. Yes. Other topics include interoperability and architecture.
 4

5 **Q. What do you mean by interoperability?**

6 A. The National Institute of Standards and Technology identifies interoperability as

7 The capability of two or more networks, systems, devices, applications, or
 8 components to work together, and to exchange and readily use
 9 information—securely, effectively, and with little or no inconvenience to
 10 the user. The smart grid will be a system of interoperable systems; that is,
 11 different systems will be able to exchange meaningful, actionable
 12 information in support of the safe, secure, efficient, and reliable operations
 13 of electric systems. The systems will share a common meaning of the
 14 exchanged information, and this information will elicit agreed-upon types
 15 of response. The reliability, fidelity, and security of information exchanges
 16 between and among smart grid systems must achieve requisite performance
 17 levels.³⁸
 18

19 Interoperability is important to include in the beginning and ensure that a process is
 20 followed because it will be less expensive over time to integrate various technologies from
 21 a variety of vendors. Without interoperability, the utility may need to implement
 22 integration layers between the different products, which increases costs. In the alternative,
 23 the utility will rely on proprietary solutions, which limits customer choice and customer
 24 benefits. As noted in the representative architecture from DOE, below, interoperability
 25 must flow throughout the utility to ensure access is available to the groups that need it.
 26

27 **Q. What do you mean by architecture?**

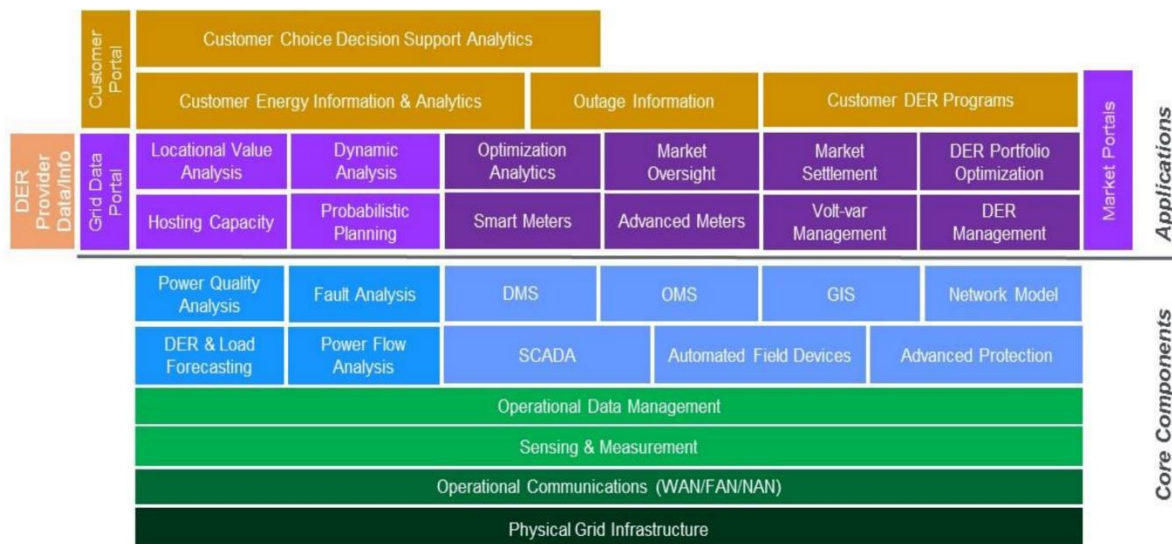
28 A. An example of a representative architecture for future integrated grid planning was
 29 developed by the DOE's DSPx initiative. Figure 8 of Volume III of the Modern
 30 Distribution Grid outlines a representative architecture of what the next generation of
 31 distribution planning may start to resemble.³⁹ In this instance, the distribution system is

³⁸ "NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0," National Institute of Standards and Technology, at pages 20-21 (September 2014). Available at: <https://www.nist.gov/sites/default/files/documents/smartgrid/NIST-SP-1108r3.pdf>.

³⁹ DSPx Volume III at page 26.

built on several core components that are shared by certain utility functions and applications, many of which were identified in the Plan and by Witness Oliver, such as power quality management, distribution management, and outage management.⁴⁰ However, the image also notes that other utility functions also need access to the same information in the development of their projects, including the utility's network model and information to run their forecasts. This also supports the image discussed previously regarding the need to integrate distribution planning with forecast modeling, resource planning, and transmission planning.

Figure 8: Next Generation Distribution System Platform & Applications



Q. Have any other states considered grid architecture as part of their initiatives?

A. As noted above, the DSPx initiative was done to support the grid modernization initiatives and visions of several states. Additionally, in 2018, the Public Utilities Commission of Ohio (PUCO) released its Power Forward report which outlines the future of the electricity system in Ohio.⁴¹ Included in the report is a discussion of grid architecture that utilizes the image above as guidance for a distribution system architecture for Ohio's distribution

⁴⁰ Oliver Testimony at 10-11.

⁴¹ "Power Forward: A Roadmap to Ohio's Electricity Future," Public Utilities Commission of Ohio (August 2018). Available at: <https://www.puco.ohio.gov/industry-information/industry-topics/powerforward/powerforward-a-roadmap-to-ohios-electricity-future/>.

1 utilities. The PUCO stated that the Ohio distribution utilities should “work towards
2 developing a cyber-physical platform consisting of uniform core components, so that the
3 foundation for customer engagement and market participation in providing innovative
4 products and services is set in the state. The goal of a uniform platform is to enable a variety
5 of market opportunities, regardless of service territory, and to create efficiencies that can
6 be passed along to customers either through the proliferation of a more diverse set of retail
7 market offerings or through cost savings associated with the different types of products and
8 services.”⁴²

9 **V. RECOMMENDATIONS**
10

11 **Q. What is missing from DEC’s Plan overall?**

12 A. First, DEC attempted the first step of an overarching plan and strategy, which is to identify
13 trends in order to orient its investments towards meeting those trends. However, DEC fails
14 to moor those trends to its Plan and related investments.

15
16 Second, it is unclear whether the investments identified in DEC’s Plan support a long-term
17 view or strategy to evolve its distribution system into a true two-way distribution system,
18 and what are the foundational investments needed for that evolution.

19
20 Third, DEC fails to identify how it is using data to inform its investments. It lists 19
21 programs with little to no detail about its decision-making on those programs and where
22 DEC intends to locate those investments.

23
24 Fourth, DEC provides no details on how existing processes, such as demand forecasting or
25 interconnection, were used in the formulation of its plan.

26
27 Fifth, Duke has experience with understanding the changing nature of technology and
28 attempting to future-proof these investments as much as possible. For example, in 2017
29 Duke Ohio requested approval from the Public Utilities Commission of Ohio to spend \$143

⁴² *Id.* at 15.

1 million to replace its initial AMI investment after it was found that the initial AMI was
2 insufficient for the needs of the utility.

3
4 Lastly, DEC fails to provide details on how customers will benefit from these investments,
5 either explicitly by facilitating integration of customer resources into utility planning
6 processes, or implicitly by removing barriers to access technologies, markets, or data to
7 facilitate their own choice.

8 **Q. What information should DEC provide as it relates to distribution system planning?**

9 A. DEC fails to provide, but should provide, an explanation or show how it is seeking to plan
10 for and manage its system differently going forward. Both its testimony and its Plan reflect
11 a short-term view of its system with a patchwork of investments that are not integrated or
12 aligned when the State needs a more integrated and future-oriented distribution system that
13 makes more and better use of DER in its planning. Many of these issues were raised by
14 stakeholders during their stakeholder outreach effort in advance of this filing. DEC should
15 take the input from knowledgeable stakeholders to help the utility break out of the same
16 way of thinking and, as the State has rightly identified, move to a more transparent planning
17 process centered around a Framework for what the utility plans should address.

18 In order to support a more transparent process, DEC should provide more information
19 about its planning process including:

- 20 • Describe more clearly and specifically the details of the purpose, need, and
21 implementation for its distribution investments;
- 22 • Develop a transparent distribution system planning process that clearly
23 identifies a planning structure to align and organize investments over a longer-
24 term horizon;
- 25 • Identify more explicit linkages and alignment with its resource planning,
26 transmission planning, distribution planning and forecast and modeling groups;
- 27 • Develop criteria to determine viability for non-wires alternatives;
- 28 • Describe how it currently models and forecasts demand and how it is planning
29 to model DER adoption;

- Develop a list of foundational or priority investments to support the evolving distribution utility; and,
- Describe how DEC anticipates using data generated by AMI, other technologies, and its interconnection processes to better inform its planning processes and distribution system needs.

Q. What would you recommend to the Commission going forward?

A. The Commission should reject DEC's proposal in its current form. DEC should then engage in a descriptive and transparent Commission approved distribution planning process before approval of these costs and investments is considered. The Plan is inadequate for the purposes of the State, or even the lofty goals as articulated by Witness Oliver. The Plan needs clear alignment with the megatrends identified by Witness Oliver, and it should also state how all distribution investments, not just those identified in the Plan, will meet customer expectations.

Second, the Commission should direct DEC to hold more workshops with stakeholders and customers to gather specific information sought by stakeholders. Stakeholders have already stated they are interested in better interconnection processes, development of hosting capacity processes, development of integrated distribution system planning, and better utilization and integration of DER. A component of these meetings should be to provide education to stakeholders on DEC's current distribution planning process so that all stakeholders have a common grounding in DEC's operations and planning functions.

Third, DEC must describe how it is improving coordination across its departments so that each group is using the best set of information, assumptions, and forecasts in order to ensure that all groups are moving forward in alignment.

Fourth, DEC must provide additional details about each of its investments as identified in the Plan. This must include detailed descriptions of the investments, specific cost and benefit models, how it is aligned with other components of the Plan, and how customers and third party resources may be capable of providing these services, such as in the case of

1 volt/VAR optimization or identification of potential NWA pilots. In addition, DEC must
2 also more clearly describe how it is building interoperability into its investment and
3 planning functions.
4

5 Fifth, DEC should provide an explanation of how a customer can obtain their own usage
6 information, and a process by which customers can authorize third parties to obtain
7 customer usage information via an open standard, and in a manner that facilitates the easy
8 sharing of customer information with an authorized third party.
9

10 Sixth, DEC should do more to utilize advanced customer-side technologies like advanced
11 inverters, and revise existing rules, such as interconnection rules, accordingly.
12

13 Seventh, DEC should work with stakeholders to develop an initial integrated distribution
14 plan that outlines short-term, mid-term, and long-term trajectories, lays the foundation for
15 necessary investments in the distribution system, and organizes an investment schedule
16 built around the customer.
17

18 Based on the above concerns, the Commission should reject DEC's Plan and related
19 requests for approval. The Plan as filed is inadequate for the Commission to render an
20 informed decision on its reasonableness, as there is simply an insufficient amount of
21 information available in this filing to justify approval. This is especially important since
22 DEC is seeking pre-approval for the costs in this Plan without additional oversight of
23 whether the Plan actually achieves measurable benefits for customers.
24

25 VI. CONCLUSION

26 The Plan as submitted by DEC is an initial step of what should be many more in order to
27 plan and outline the necessary investments to put DEC and South Carolina on a path for
28 the future. However, the Plan is merely a step. This Plan as submitted by DEC is
29 insufficient to justify the expenditures as requested by DEC. The Plan is lacking in the
30 following areas:

- Provides little detail on the justification for the identified investments;
- Does not put DEC, its customers, or South Carolina on a path to best take advantage of DER going forward;
- Fails to adequately describe how these investments are aligned with its own distribution plan;
- Is not adequately forward-looking to justify how these investments will prepare DEC for the changes in customer demands or effectively integrate increasing amounts of DER;
- Does not support or promote customer choice;
- Is not sufficiently integrated with other areas inside the utility operations, including resource planning, demand forecasts, technology development, and optimization of DER; and,
- Does not provide justification for pre-approval of these investments.

The role of the distribution system is under evolution, and is in need of upgrade. However, just because the distribution system is in need of upgrade is not itself a justification for large amounts of investments without a broader and overarching goal, vision, strategy, and a plan. The Plan as submitted by DEC is lacking in all those areas, and should not be approved by the Commission without more details on the investments, more stakeholder meetings, education of stakeholders, and a more thorough distribution system planning process.

Q. Does this complete your testimony?

A. Yes.